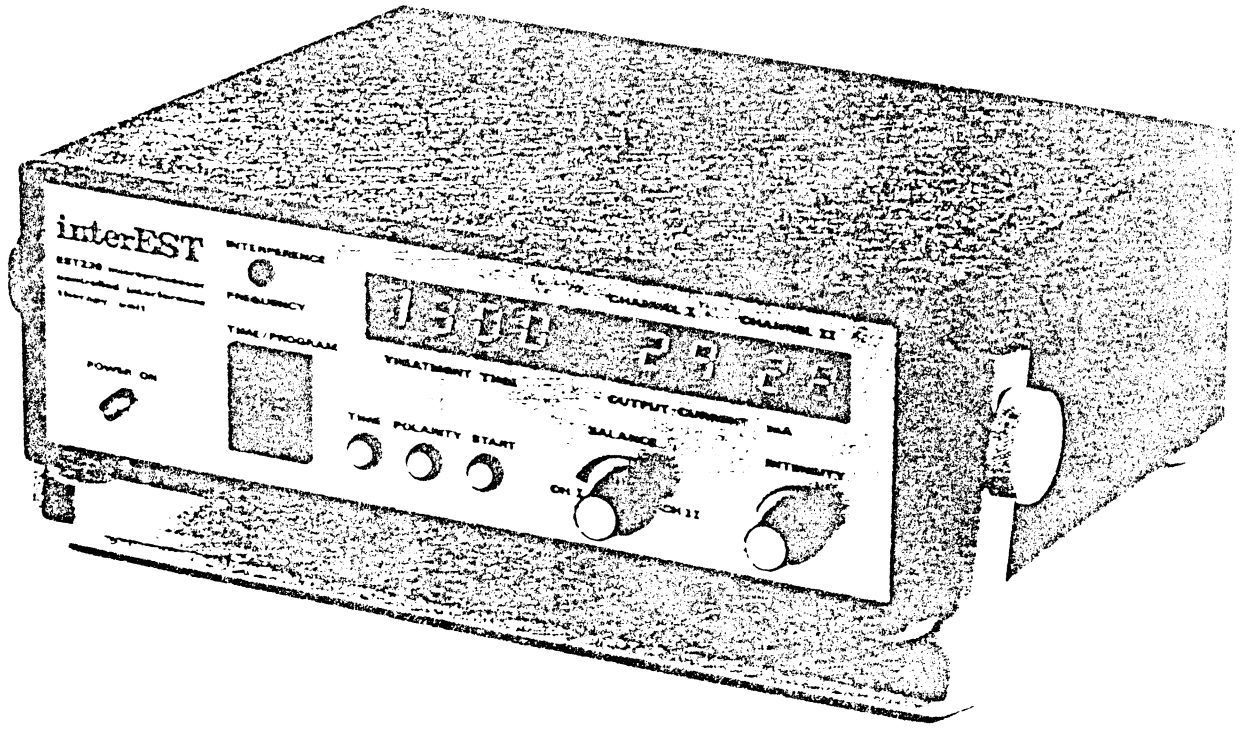
escotek ky

interEST EST220

Interference therapy unit

service manual



I N T E R F E R E N C E T H E R A P Y U N I T
i n t e r E S T E S T 2 2 0

O P E R A T I N G D E S C R I P T I O N

IN GENERAL

There are two galvanically separated current driven outputs (channels I and II) in the interference therapy unit. The output of the channel II is constant 4000 Hz sinusoidal current. The output current frequency of the channel I can be programmed to 3800-4000 Hz with an increment of 0,2 Hz. When the load impedance is 1 ohm (outputs in short circuit), the maximum intensity of the output current is 100 mA. When the two electrode therapy is used the currents are added inside the unit and the output current comes from the channel I. When the positive polarity is used the negative halfwaves of the sinusoidal output currents are cut off. Analogously when the negative polarity is used the positive halfwaves are cut off. The intensities of the output currents and the treatment time are indicated by the current meter and the treatment time clock of the display. The treatment program or the wanted treatment time are selected by thumbwheel switches. POLARITY-, START- and TIME-bushbuttons control the polarity, starting the treatment and seting the treatment time (see user´s manual of the interference therapy unit 4X10900).

OPERATING DESCRIPTION

The block diagram of the interference therapy unit is shown in fig. 3A10900 and the schematic diagram is shown in fig. 1B10900. Components layouts for PC-boards 1F10900 and 2F10901 are shown in figures 1C10900 and 2C10901.

The power supply of the unit consists of a transformer T1, diodebridges (D1-D12), 5V regulators (IC1,IC2) and 91V regulation circuits (Z1,Q2,Z2,Q3). Supply voltages for the both PC-boards are generated by separate regulators. Because of the galvanic isolation between the outputs there is a separate supply voltage for the both output amplifiers. The supply voltage for the output amplifier of the channel I is regulated by the 91V regulation circuit consisting of the zenerdiode Z1 and transistor Q1. Analogously the supply voltage for the channel II is regulated by the equal circuit (Z2,Q3).

The frequency of the channel I is generated by a phase-locked-loop circuit IC3 consisting of a phase-comparator and a voltage controlled oscillator. The passive low-pass-filter of the loop consists of resistors R7 an R10 and cpacitors C27 and C28. The frequency range of the oscillator is controlled by resistors R8 and R9 and capacitors C29 and C30. As the programmable divider of the loop operates the second counter of the timer IC19. The divider N of the counter is controlled by the program and the output (point 3) of the timer works as the other input of the phase-comparator. The other input frequency f_r (point 2) is generated by the first counter of the timer IC19. The output frequency f_o of the oscillator is divided by a counter circuit IC4 with a divider 64. For the output frequency of the channel I can be written an expression $f_I=(N \times f_r)/64$, where N is an even total number. When $f_r=50,000$ Hz (=1MHz/20000) the corresbonding values of N for the frequencies 3800 Hz and 4000 Hz are 4864 and 5120. When N=4866 the output frequency is 3801,6 Hz. By changing the divider of the first counter for 20002, the reference frequency 49,995 Hz (=1MHz/20002) is generated. Now when N=4866 the output frequency is 3801,2 Hz (differs 0,4 Hz from the former value 3801,6 Hz). Analogously by using dividers 20004 and 20006 for generating reference frequency (reference frequencies 49,990 Hz and 49,985 Hz), the output frequency can be changed with steps of 0,4 Hz. By changing adjacent reference frequencies with steps of 10 ms the output frequency can be changed with steps of 0,2 Hz. The frequency range of the voltage

controlled oscillator has to be at least 243,2...256 kHz (3800Hz x 64...4000Hz x 64). The frequency range of the voltage controlled oscillator is adjusted for suitable by a capacitor C30 connected in parallel with a capacitor C29.

The output frequency of the channel II (point 5) is generated by the counter 3 of the timer IC19. The difference of the output frequencies (interference frequency) comes from the output (pin 9) of a D-flipflop IC13. This difference frequency controls by a transistor Q40 the blinking of the green indicator LD1, INTERFERENCE FREQUENCY. Futuremore the difference frequency is connected via the PIA-circuit IC15 to the microprocessor, where the difference is needed for calculating the output current when the two electrode therapy is used.

The 5V square signals of the both channels are supplied to binary controlled attenuators (IC8). By the aid of 6 bits control words coming from the PIA-circuit IC15, 64 ($=2^6$) different values of attenuation can be chosen. Binary coded precision resistors (R11...R16 and R19...R24) connected suitable in parallel by CMOS-analogy-switches (IC5...IC7) controls the attenuatin value. These attenuators controlled by the program are used to rotate the interference vector when the four electrode therapy is used (see the user´s manual). When all the CMOS-switches are ON the level of the points 6 and 7 are adjusted to about $0,9V_{pp}$.

The square signals of the points 6 and 7 are filtered to sinusoidal by a band-pass-filters (IC8). When the frequency of the channel I is 3950 Hz the level in point 8 is adjusted to maximum (about $0,6V_{pp}$) by RT2. The level of the channel II in the point 9 (frequency constant 4000 Hz) is adjusted to maximum (about $0,6V_{pp}$) by RT4.

The control of the intensity and the balance is carried out by adjustable amplifiers. By a 10 turns tandem potentiometer PT1 is adjusted simultaneously the intensities of the both channels. A tandem potentiometer PT2 is so wired that when the intensity of

the channel I is increased by PT2 the intensity of the channel II is decreased and vice versa.

The output of the adjustable amplifiers are supplied via isolation transformers T2 and T4 to the output amplifiers (Q5...Q9 and Q13...Q17). The output amplifiers are wired to operate as current sources by means of output transistors (Q8,Q9 and Q16,Q17). The cross-over-distortions of the outputs are adjusted to minimum by trimmers RT5 and RT7. When the outputs are in short circuit, the highest output current of the both output amplifiers is 100mA. When the output load is 1k , the highest not clipped output current is about 40 mA.

When the polarity is positive a relay Re2 connects diodes D20 and D23 to the outputs. Then the negative half-waves of the outputs are cut off. Analogously when the negative polarity is used diodes D19 and D22 cut off the positive half-waves. Relays Re1 and Re2 are controlled by the PIA-circuit IC15. Changing the polarity is controlled by the polarity seting bushbutton S2 (POLARITY) via the PIA-circuit IC16. The polarity is indicated b^ an indicator which is on the display (IC25) of the current meter for the channel I.

When the two electrode therapy is used the PIA-circuit IC16 sets a transistor Q20 to OFF-state. Then a transistor Q21 turns to ON-state and a relay Re4 connects the outputs of the channel II in parallel with the outputs of the channel I. Thus the sum-current of the channels comes from the channel I and at the same time the channel II is disconnected.

To measure the output currents there are trimmers RT6 and RT8 in series with the outputs. The alternating voltages which are generated across the trimmers are supplied via isolating transformers T3 and T5 to a AC/DC-converter (IC10). RT6 and RT8 are so adjusted that an 1 mA change in output current generates 15 mV DC-change in the outputs of the converters (points 10 and 11).

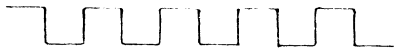
The outputs of the AC/DC-converters are supplied to the inputs of a 6-channel AD-converter IC11 which operates in integrating priciple. The controls of the AD-converter for selecting the channel and the RAMP START-control come from the PIA-circuit IC15. From the output of a NAND-gate IC12 (point 12) comes a pulse which has a duration propotional to the input voltage. The duration of the pulse is measured by the third counter of the timer IC18. Thus the DC-voltages propotional to the output currents are converted into digital words, which control via the PIA-circuit IC15 the current meters of the display.

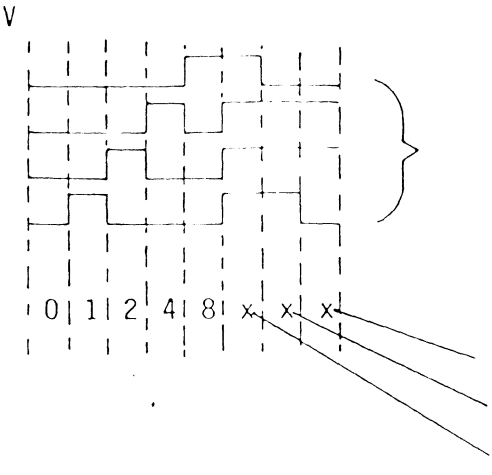
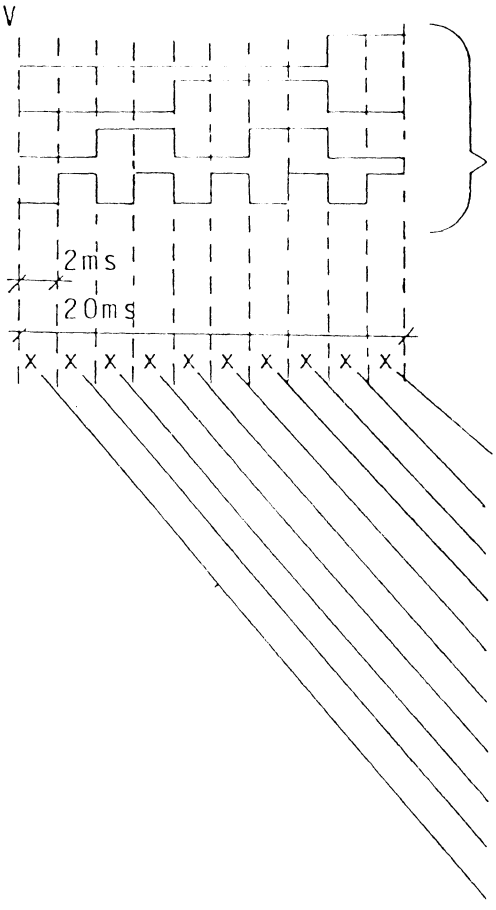
The microprocessor of the unit consists of a CPU-circuit (IC17), two PIA-circuits (IC15,IC16), two timers (IC18,IC19) and a EPROM-memory (IC20). The PIA-circuit IC15 controls the attenuation of the both channels (IC5...IC8), the channel selection of the AD-converter (IC11), the RAMP START-control of the AD-converter, the polarity relays (Re1 and Re2) and the buzzer (B1). The PIA-circuit IC16 reads the positions of the thumbweel switches (S5,S6) and the interrupts coming from them START-, POLARITY- and TIME-switches. Futuremore the PIA-circuit IC16 controls the display and relays (Re3,Re4) which select the two or four electrode methode. The first counter of the timer IC19 generates reference frquencies for the phase-locked-loop, the second counter operates as a programmable counter for the phase-locked-loop and the third counter generates a frequency 4000 Hz for the channel II. The second counter of the timer IC18 generates a frequency 500 Hz, which produces interrupts to control the treatment time and the multiplexing of the display. The third counter of the IC18 measures the integration time of the AD-converter.

The display unit consists of the treatment time clock (IC26...IC29), the current meter for the channel I and the current meter for the channel II. A BCD/decimal decoder IC22 controls via transistors Q30...Q39 the common cathodes of the digits in multiplexing principle. The segments of the digits are controlled by a BCD/7-segment decoder IC21 and by transistors Q23...Q29.

VOLTAGES AND WAVEFORMS OF THE MEASUREMENT POINTS AND TUNING THE UNIT

When measuring and tuning the unit use the testprogram 00

Measurement point	Measurement result	Remarks
		-Switch POWER ON -POWER ON indicator lights -Display 00.00 00 00 -Clock goes forwards with increment of 1 second
1	5 V DC	
A	5 V DC	
B-C	95 V DC	
D-E	95 V DC	
13	5V 	frequency 1,000 MHz
		-Select PROGRAM/TIME 00 -Push START -Display 00.00 00 00 -Select PROGRAM/TIME 11 -Push TIME -Display 11.11 11 11 -Select PROGRAM/TIME 22 -Push START -Display 22.22 22 22 -Select PROGRAM/TIME 44 -Push START -Display 44.44 44 44 -Select PROGRAM/TIME 88 -Push START -Display 88.88 88 88

Measurement point	Measurement result	Remarks
PCB2 5 " 6 " 7 " 8		MSB Data of the display 6 or - sign 7 or + sign blanko
PCB2 9 " 10 " 11 " 12		MSB Multiplexing the display clock tens of minutes " ones " " " tens " seconds " ones " " +/- sign channel I, hundreds of current meter " , tens of current meter " , ones of current meter channel II, tens of current meter " , ones of current meter

-Select PROGRAM/START 00
-Push START
-Display 00.00 00 00
-Clock goes fowards with increment of 1 second
-Select value for C30
-Operating range of VCO 243...256 kHz
-Lower limit IC3 pin 9 to ground, upper limit IC3 pin 9 to +5V

5V

2 cycle duration 20,00 ms (frequency 50,00 Hz)

3 cycle duration 20,00 ms (frequency 50,00 Hz)

4 frequency 252,8 kHz

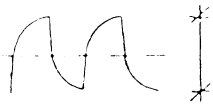
5 frequency 4000 Hz

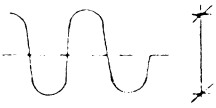
PCB2 13 frequency 50,00 Hz (control of LED1)

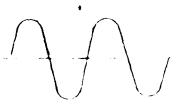
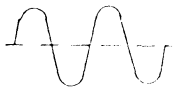
F $1,7V_{DC}$

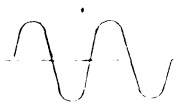
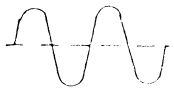
6 $1,7V_{DC}$ $0,9V_{pp}$ frequency 3950 Hz -Adjust level by RT1

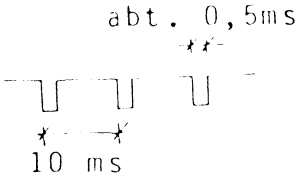
8 $1,7V_{DC}$ $0,6V_{pp}$ -Adjust level to max. by RT2

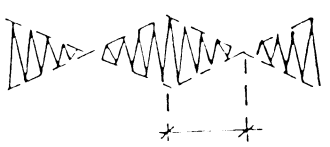
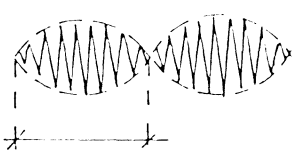
7 $1,7V_{DC}$  $0,9V_{pp}$ frequency 4000 Hz -Adjust level by RT3

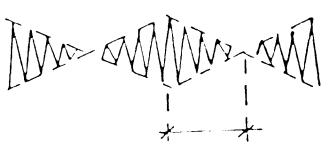
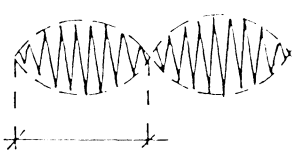
9 $1,7V_{DC}$  $0,6V_{pp}$ -Adjust level to max. by RT4

Measurement point	Measurement result	Remarks
		-Connect to outputs CHI and CHII a load 50 /1W -Adjust the output of the CHI to max. by BALANCE (PT2) and by INTENSITY (PT1) controls -Adjust cross-over-distortion to min. by RT5
CH I	$0V_{DC}$  $10V_{pp}$	frequency 3950 Hz -Adjust level by RT1
10	$3,0V_{DC}$	-Adjust level by RT6 -Adjust the display of the CH I to 99 by RT6
		-Adjust the output of the CHII to max. by PT2 (PT1 adjusted to min.) -Adjust cross-over-distortion to min. by RT7
CHII	$0V_{DC}$  $10V_{pp}$	frequency 4000 Hz -Adjust level by RT3
11	$3,0V_{DC}$	-Adjust level by RT8 -Adjust the display of the CH II to 99 by RT8
		-Adjust the levels of the CH I and CH II to equal by PT2 (PT1 adjusted to max.)

Measurement point	Measurement result	Remarks
		-Connect to outputs CHI and CHII a load 50 /1W -Adjust the output of the CHI to max. by BALANCE (PT2) and by INTENSITY (PT1) controls -Adjust cross-over-distortion to min. by RT5
CH I	$0V_{DC}$  $10V_{pp}$	frequency 3950 Hz -Adjust level by RT1
10	$3,0V_{DC}$	-Adjust level by RT6 -Adjust the display of the CH I to 99 by RT6
		-Adjust the output of the CHII to max. by PT2 (PT1 adjusted to min.) -Adjust cross-over-distortion to min. by RT7
CHII	$0V_{DC}$  $10V_{pp}$	frequency 4000 Hz -Adjust level by RT3
11	$3,0V_{DC}$	-Adjust level by RT8 -Adjust the display of the CH II to 99 by RT8
		-Adjust the levels of the CH I and CH II to equal by PT2 (PT1 adjusted to max.)

Measurement point	Measurement result	Remarks
12		-Display XX.XX 76 76 -Adjust by PT2 the level of CHI to max. -Display XX.XX 99 44 -Adjust by PT2 the level of CHII to max. -Display XX.XX 44 99 -Adjust by PT2 the levels of CHI and CHII to equal -Display XX.XX 76 76 -Adjust PT1 to min. -Display XX.XX 00 00 -Adjust PT1 to max. -Display changes from XX.XX 00 00 to XX.XX 76 76 and at the same time the outputs of CHI and CHII change from 0V $_{pp}$ to 7,6V $_{pp}$
CHI ja CHII		-Push POLARITY -Display XX.XX +81 81
CHI ja CHII		-Push POLARITY -Display XX.XX -79 79

Measurement point	Measurement result	Remarks
		-Push POLARITY -Display XX.XX 78 78 -Push START
CHI	7,8V pp	
CHII	 7,8V pp 13 sec	
		-Push START -Display XX.XX 95
CHI	 15V pp 20 ms	
		-Push START -Display 00.00 00 00 -Acoustic alarm 3 x 0,3 sec

Measurement point	Measurement result	Remarks
		-Push POLARITY -Display XX.XX 78 78 -Push START
CHI	7,8V pp	
CHII	 7,8V pp 13 sec	
		-Push START -Display XX.XX 95
CHI	 15V pp 20 ms	
		-Push START -Display 00.00 00 00 -Acoustic alarm 3 x 0,3 sec

INTERFERENCE THERAPY UNIT interEST EST220

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INTERFERENCE THERAPY UNIT interEST EST220

TECHNICAL SPECIFICATIONS

Mains supply:	220 V / 50 Hz (with internal change 110 V / 60 Hz)
Input power:	44 W max.
Input current:	200 mA max. (400 mA with 110 V)
Mains protection:	2 x T 315 mA
Outputs:	Two separate outputs, channel I and channel II
Output current:	Peak current continuously adjustable 0...100 mA when using both channels and 4 electrodes, 0...100 mA when using channel I and 2 electrodes (channel II not used)
Output current meter:	Digital peak current meter 0...199 mA with channel I and 0...99 mA with channel II
Outputs´ protection:	2 x T 160 mA
Output frequency:	Channel I fixed 4000 Hz, channel II 3800...4000 Hz depending on the treatment program
Interference frequency:	0...200 Hz depending on the treatment program with 0.2 Hz steps
Interfernce frequency indicator:	Green indicator flashing according to the interference frequency
Balance control:	+-50% with both channels
Output polarity:	Bipolar, positive or negative
Movement of the interference vector:	90^{o} depending on the treatment program
Treatment time set:	0...99 min with 1 min steps

Treatment time indicator:	Fowards or backwards going digital clock 0...99 min 59 sec, buzzer alarms after the treatment
Selecting the treatment program:	Two thumbwheel switches, max. 99 treatment programs, program 00 is reserved for servicing and testing
Electric security:	Inspected according to the IEC601-1 standard
Dimensions:	Depth 26 cm, width 33 cm, height 11 cm, weight 3.5 kg

I N T E R F E R E N C E T H E R A P Y U N I T
i n t e r E S T E S T 2 2 0

I N S T R U C T I O N S M A N U A L

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IN GENERAL

Important frequencies in the electro-therapy are 0-200 Hz. In the interference therapy these frequencies are generated in the tissue by superposition of the two currents. Due to the high frequency of the currents the therapy is painless, even if high current intensities are used. Thus areas deep in the body can be stimulated.

INTERFERENCE THERAPY with interEST EST220

With interEST EST220 the interference therapy can be given by four electrodes, by four electrodes with the vector rotation or by two electrodes. Normal therapy methodes as different kind of frequency changes and current intensity changes are programmed into the memory of the unit. The wanted program can be selected by the two thumbwheel switches which are on the front panel of the unit.

With the programs, which have a note 4 el in the treatment program list, the normal or static interference therapy can be given. Then four electrodes and two circuits are used (fig. 1). The frequency of the one circuit (Channel II) is 4000 Hz and the frequency of the other circuit (Channel I) differs from that 0-200 Hz. In the tissue at the cross-over-point of the two currents the interference current is produced by the superposition. The interference frequecy is the difference between the frequencies of the two currents. When the frequency of the channel I is changed, different kind of interference frequencies are generated.

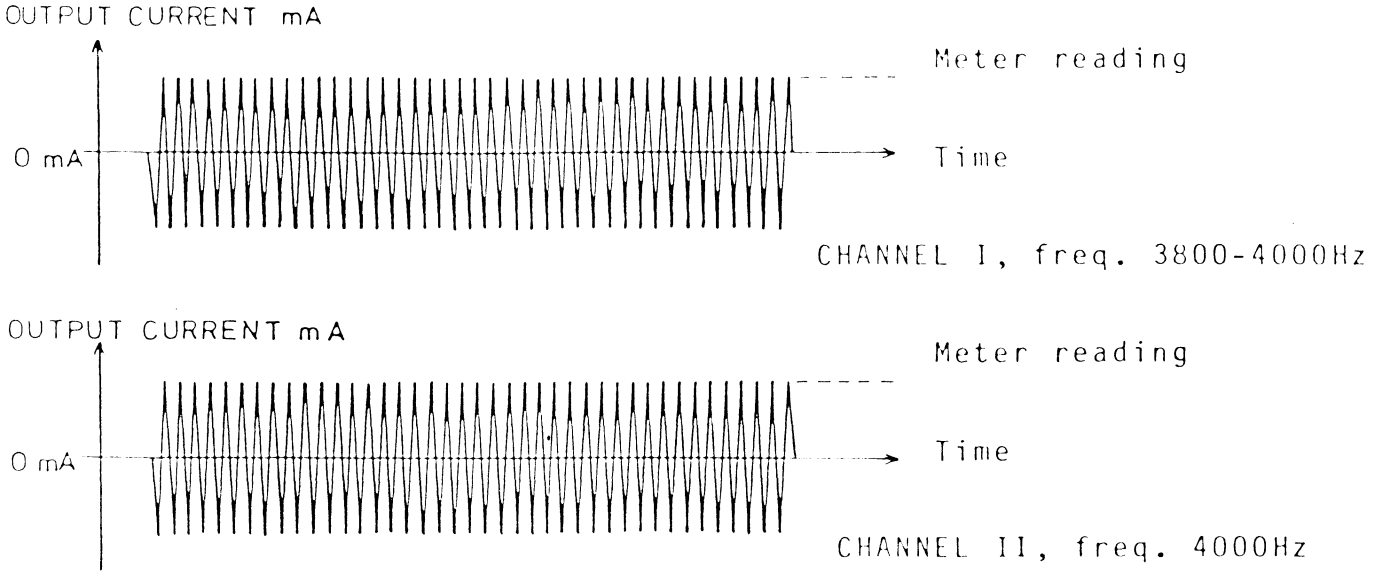


Fig. 1. The outputs of the interference therapy unit when four electrodes are used without the vector rotation (static interference therapy)

With programs which have a note 4 elV, the interference therapy of four electrodes with the vector rotation can be given. This method is known also as a dynamic interference therapy (fig. 2). The dynamic interference therapy changes the intensities of the channels in the opposite phase or when the current in the channel I increases the current in the channel II decreases. The current intensity of the one channel increases in 13 seconds from zero to maximum and decreases from maximum to zero in 13 seconds etc. When the current intensities change in the opposite phase the direction of the interference current rotates $+-45^{0}$ compared to the static interference current. Thus the area treated by the dynamic interference therapy is larger than the area treated by the static interference therapy.

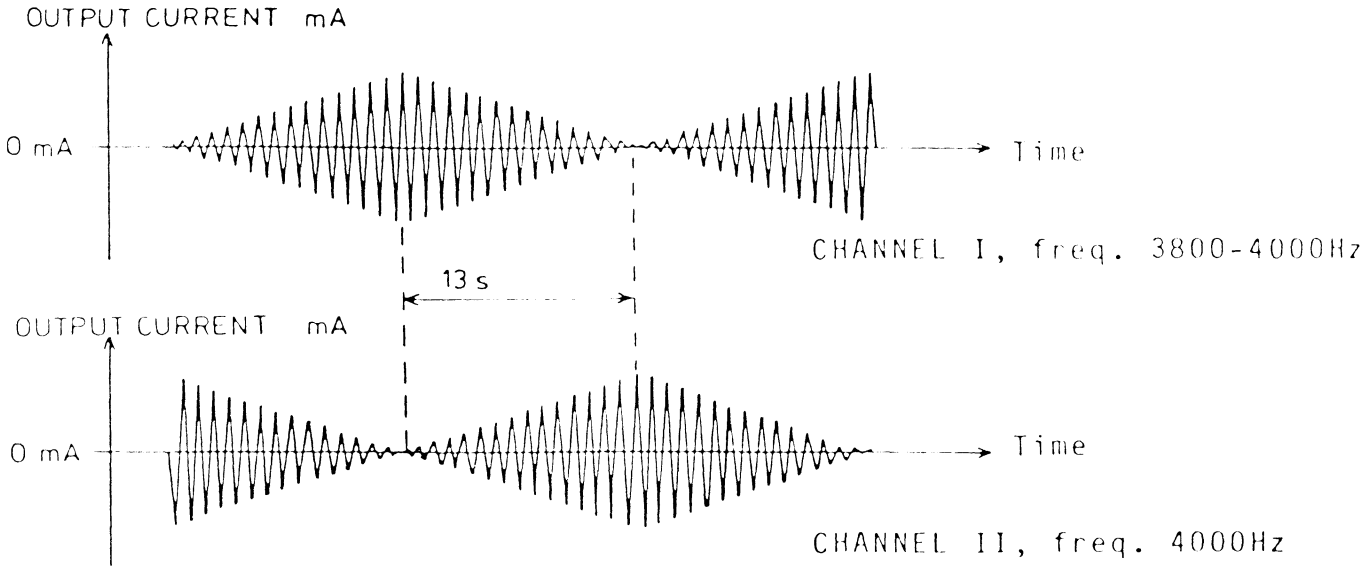


Fig. 2. The outputs of the interference therapy unit when four electrodes are used without the vector rotation (static interference therapy)

With the treatment programs noted 2 el, a bipolaric interference therapy with two electrodes can be given (fig. 3). Then as the output acts the channel I. When using the bipolaric therapy the interference current is generated inside the unit. Then only two electrodes are needed. This method is useful when small areas are to be trated.

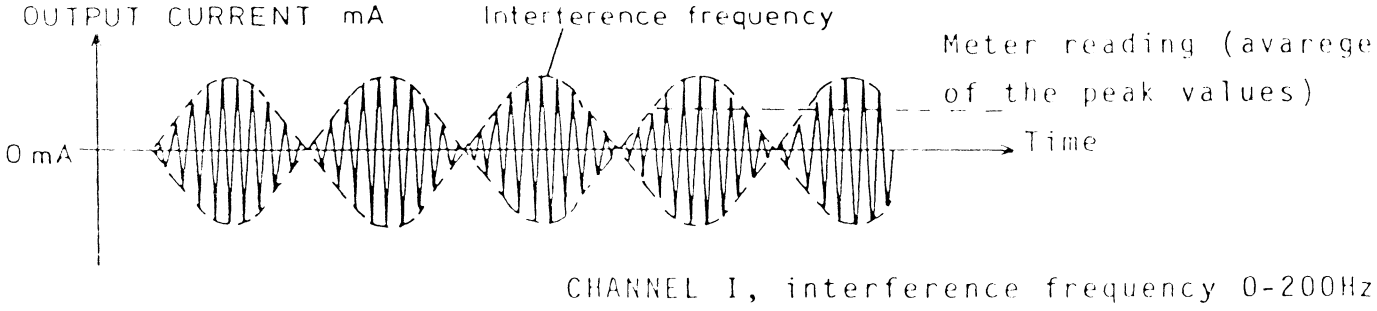


Fig. 3. The output of the interference therapy unit when two electrodes are used (bipolaric interference therapy)

There are a separate digital peak current meter for the both channels in the EST220. When the bipolaric therapy is used the meter of the channel I indicates the intensity of the output current and at the same time the meter of the channel II is dark.

A digital four-digit clock, located on the front panel of the unit, acts normally as a forwards going treatment clock. When needed the treatment time can be limited for the wanted value by means of the thumbwheel switches and the time setting bushbutton. Then the clock goes backwards from the set-value. After the treatment the buzzer of the unit alarms. The unit remembers the set-value of the treatment time as far as the mains is switched off. Exeptions are the programs whose treatment time is prorammed (programms No 73-81), then the clock goes allways backwards from the programmed value.

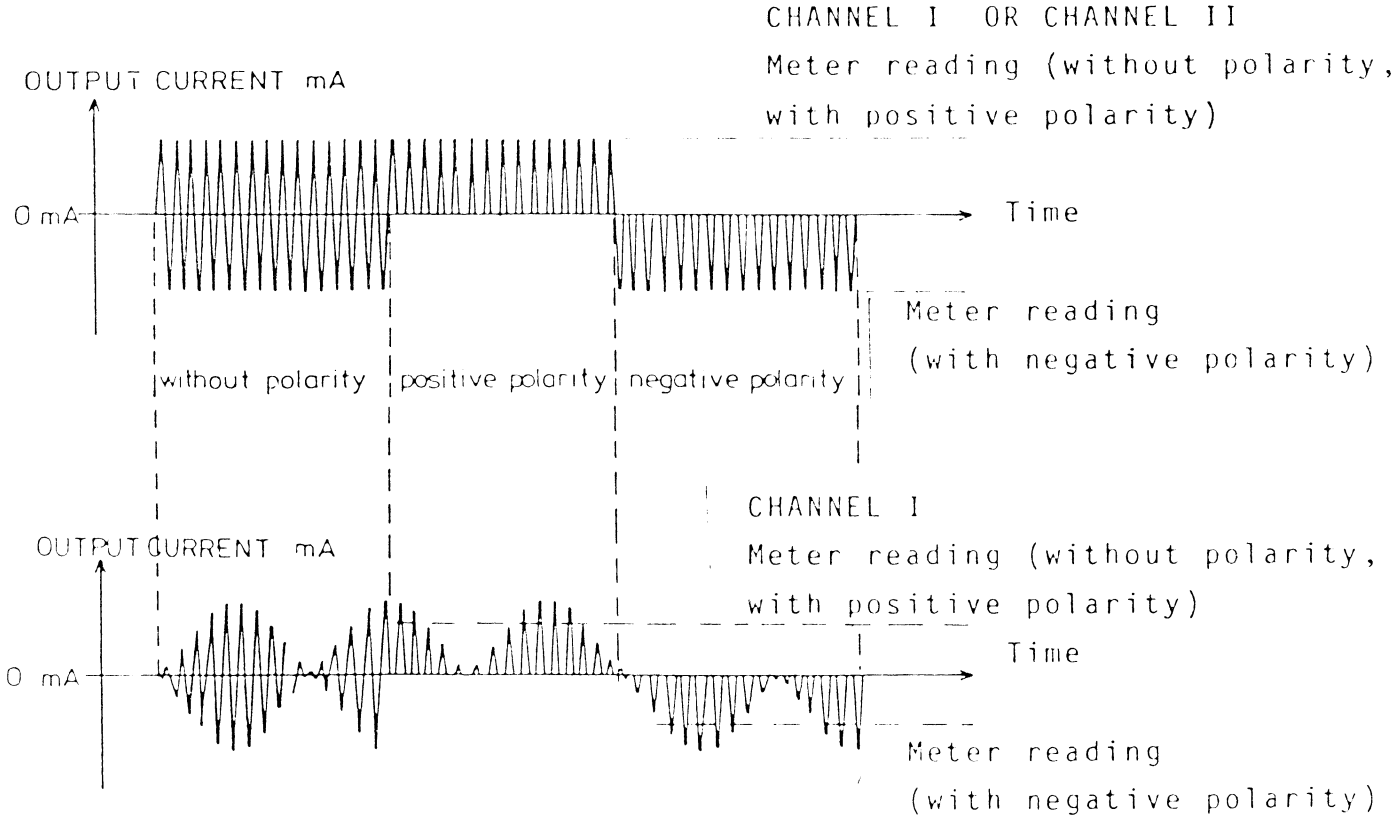


Fig. 4. The output-effect of the polarity bushbutton. Above the static and below the bipolaric interference therapy.

There are a separate digital peak current meter for the both channels in the EST220. When the bipolaric therapy is used the meter of the channel I indicates the intensity of the output current and at the same time the meter of the channel II is dark.

A digital four-digit clock, located on the front panel of the unit, acts normally as a forwards going treatment clock. When needed the treatment time can be limited for the wanted value by means of the thumbwheel switches and the time setting bushbutton. Then the clock goes backwards from the set-value. After the treatment the buzzer of the unit alarms. The unit remembers the set-value of the treatment time as far as the mains is switched off. Exeptions are the programs whose treatment time is prorammed (programms No 73-81), then the clock goes allways backwards from the programmed value.

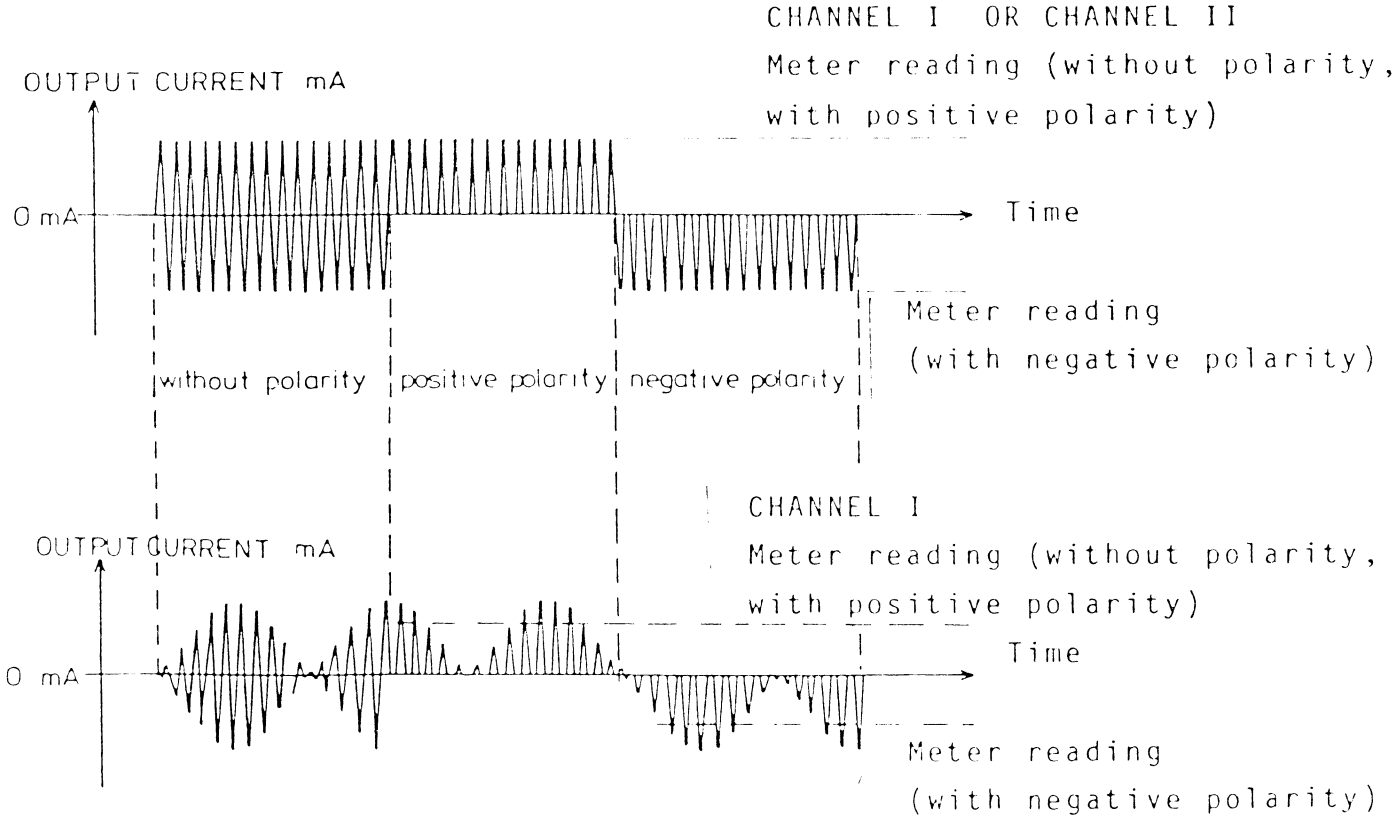
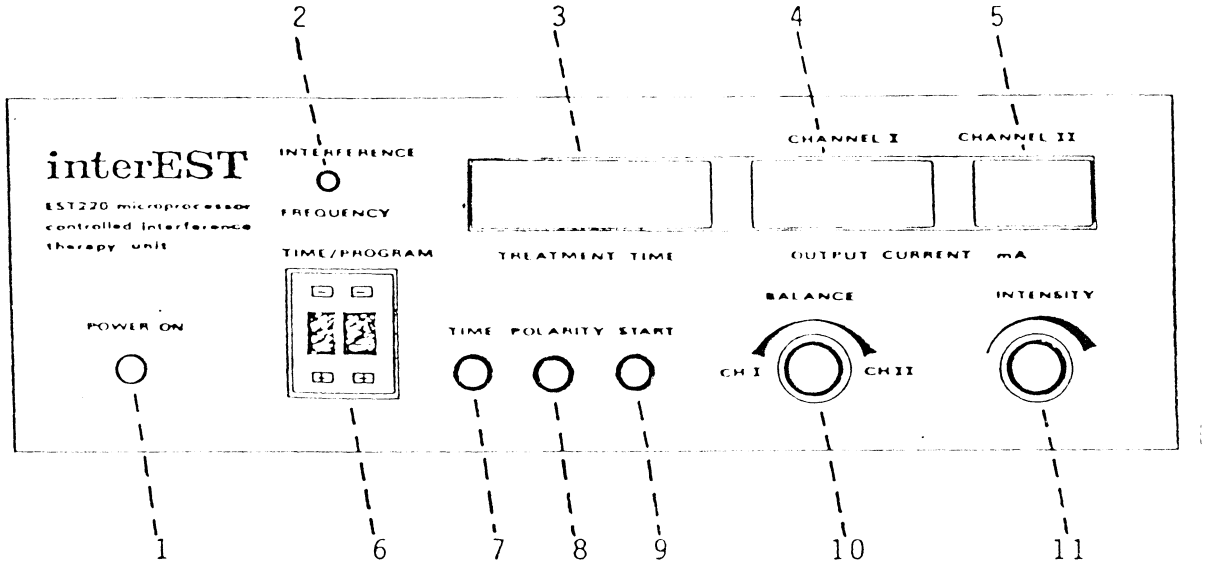


Fig. 4. The output-effect of the polarity bushbutton. Above the static and below the bipolaric interference therapy.

The current intensity of the both channels are adjusted by the intensity control. The balance between the channels is adjusted by the balance control. The green indicator on the front panel of the unit blinks at the rate of the interference frequency.

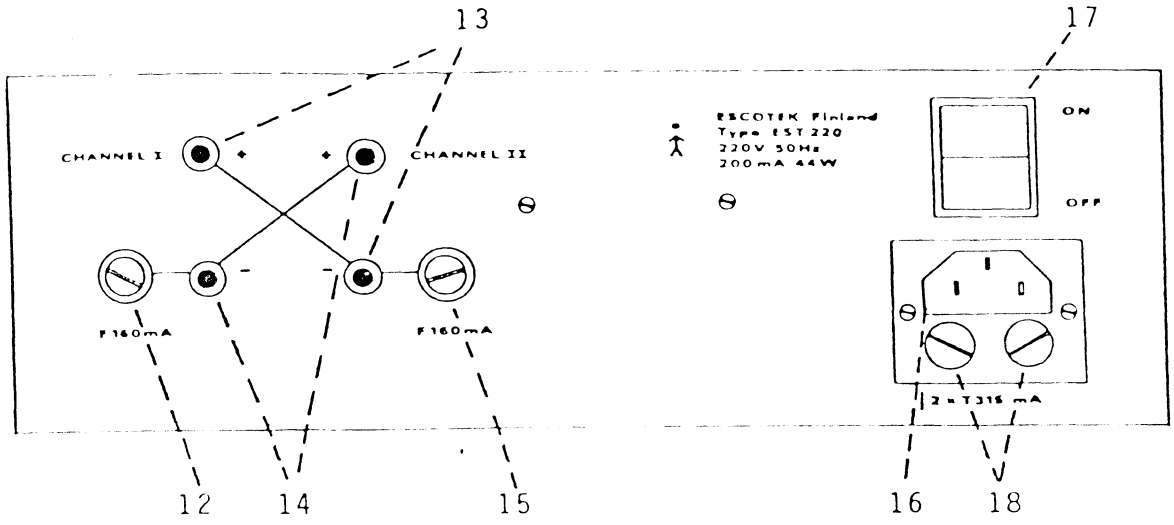
Controls and indicators on the front panel of the unit:



Kuva 5. The front panel of the interEST EST220

(1) Yellow indicator POWER ON
(2) Green indicator INTERFERENCE FREQUENCY
(3) Digital treatment time clock TREATMENT TIME
(4) Peak current meter for channel I
(5) Peak current meter for channel II
(6) Program and time thumbwheel switches PROGRAM/TIME
(7) Treatment time set button, TIME
(8) Treatment current polarity button, POLARITY
(9) Treatment start button, START
(10) Balance control BALANCE
(11) Intensity control INTENSITY

Controls and indicators on the back panel of the unit:



Kuva 6. The back panel of the interEST EST220

(12) Channel II output fuse F160mA
(13) Channel I output connectors CHANNEL I
(14) Channel II output connectors CHANNEL II
(15) Channel I output fuse F160mA
(16) Mains connector
(17) Mains switch ON/OFF
(18) Mains fuses 2xT315mA

INSTRUCTIONS FOR THE USER OF THE UNIT

Choose suitable elecltrodes and electrode covers.

Moisten the electrode covers by warm water and position the electrodes on the area to be treated (see examples for positioning the electrodes on the pages 10 and 11).

Connect the electrodes to the treatment cables. Connect the treatment cables to the output connectors CHANNEL I (13) and CHANNEL II (14) in the way that the output currents cross at the area to be treated. When you are using the bipolaric therapy use only two electrodes and the channel I (see examples for positioning the electrodes on the pages 10 and 11).

Connect the unit to the mains by the mains-cable.

Switch the unit on by the mains-switch (17), then the yellow indicator POWER ON (1) lights.

Check that the intensity control (11) is in the counterclockwise position.

If needed you can limit the treatment time to the wanted value by selecting the wanted time with the thumbwheel switches (6) (as minutes) and by bushing the TIME-switch (7). Then the treatment time appears on the display of the unit (3). The unit remembers the selected treatment time as far as the mains is switched off. If needed the set-value of the treatment time can be reset by switching the mains off or by seting the treatment time for 00.

Select the polarity of the output currents by the POLARITY-switch (8).

Set the program number by the thumbwheel switches (6) and bush the START-switch (9). The treatment begins, the green indicator (2) begins to blink at the rate of the interference frequency and the treatment time clock (3) starts. If the treatment time is limited by the user or by the program, the clock goes backwards from the set-value. In the other case the clock goes upwards from 00 00.

Adjust with the intensity control INTENSITY (11) the output current for suitable.

When you are using the four electrode therapy (static interference therapy) adjust the output currents of the channels for equal.

When you are using the four electrode therapy with the vector rotation (dynamic interference therapy) or two electrode therapy (bipolaric interference therapy), adjust the balance control to middle position.

If needed you can stop the treatment by bushing the TIME-switch, then the output current disconnects and the clock sets to the value of the bushbuttons.

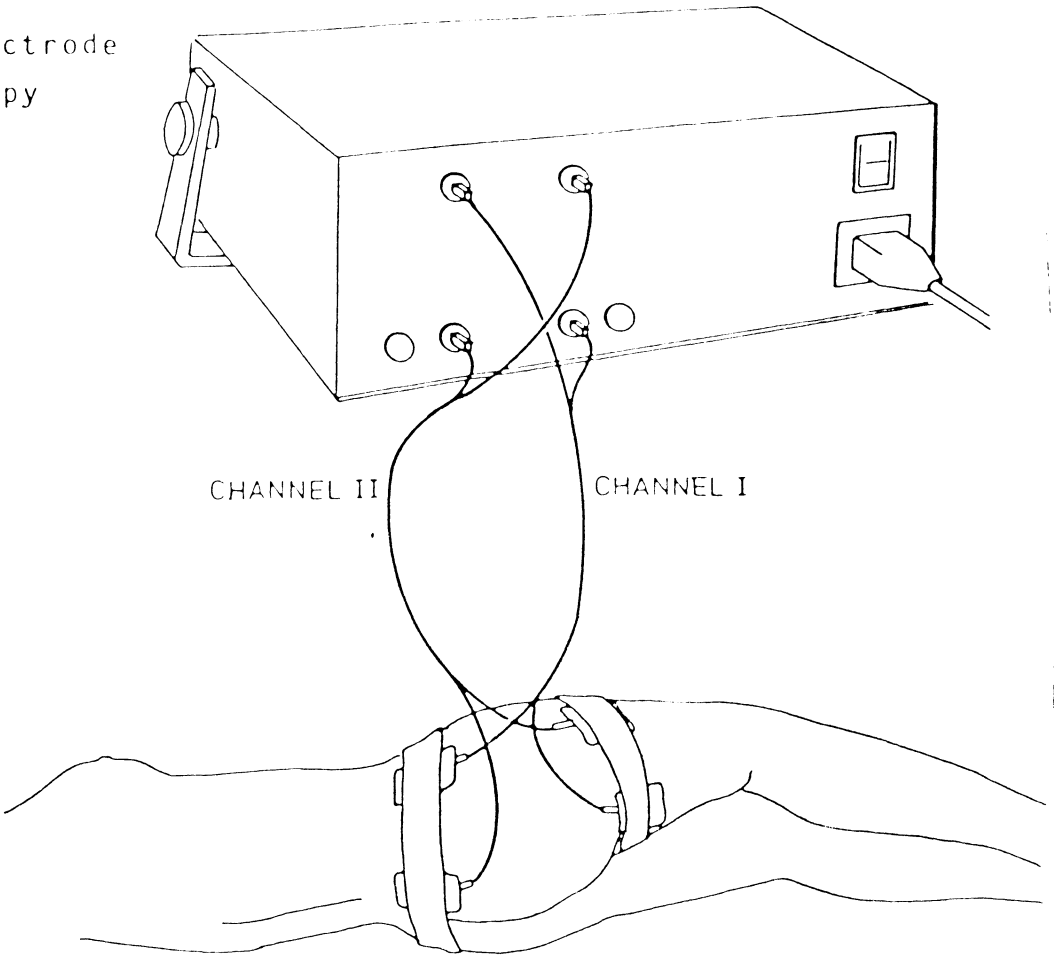
After the treatment adjust the intensity control to minimum, switch the mains off and disconnect the electrodes.

COMBINED TREATMENT

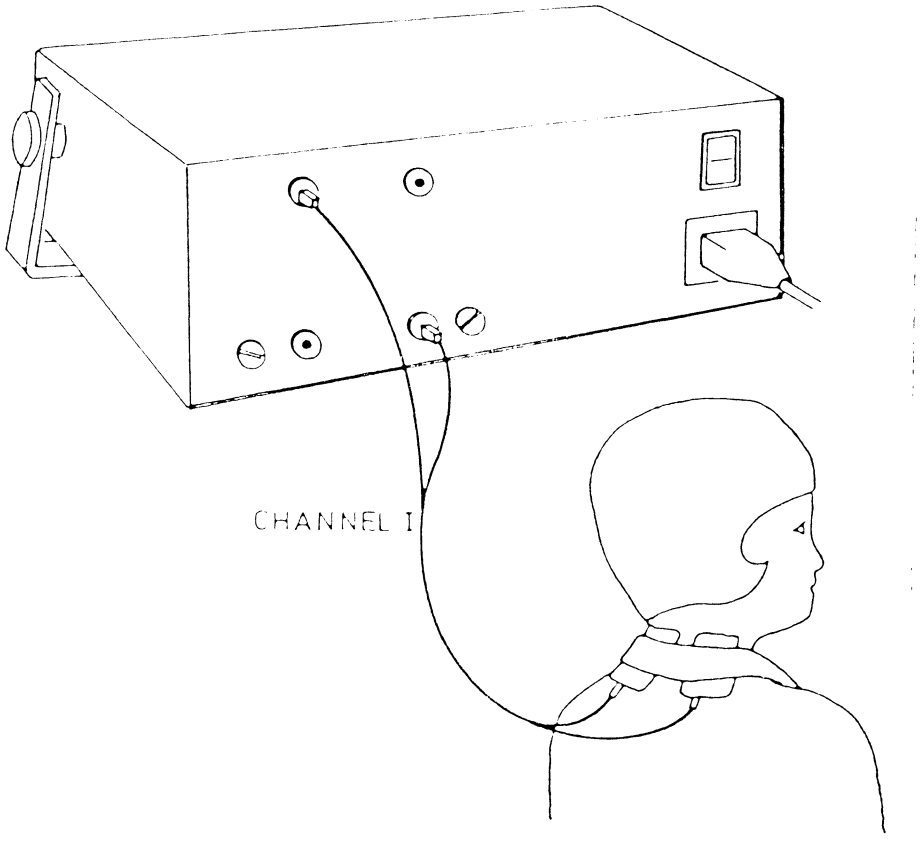
The interference therapy unit interEST EST220 can be used combined with the ultrasonic unit EST301A. When one of the output cables is connected to the COMB TREATM INPUT-connector of the EST301A, acts the treatment head as the corresponding electrode of the EST220. When the combined treatment is used, ultrasonic conductive liquid has also to be a good conductor for electricity. During the therapy the treatment head is not allowed to take off from the skin. Exact instructions for the combined treatment are in the user´s manual of the EST301A.

EXAMPLES FOR POSITIONING THE ELECTRODES

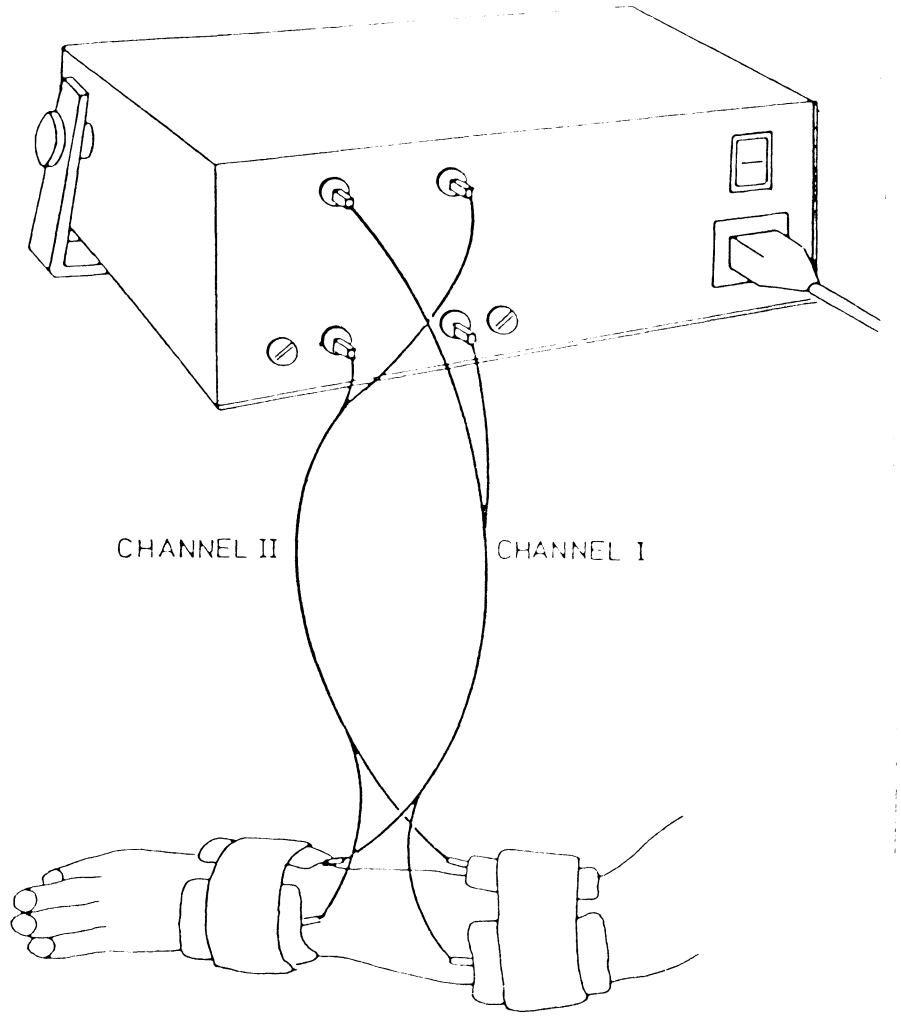
4 electrode therapy



2 electrode therapy



4 electrode therapy



TREATMENT PROGRAMS of the INTERFERENCE THERAPY UNIT interEST EST220

Principles for choosing the interference frequency

One important feature of the interference therapy is to relieve the pain. Choosing the frequency is based on the gate control theory. By stimulating the large nerve endings pain threshold can be inhibited. Then the optimal treatment frequency is between 50-100 Hz. The pain can be relieved also by means of low frequency treatment 0-5 Hz, then the pain theory is based on the own chemical effects of the organism. By experience has also be noted that the frequencies of the diadynamic currents 50 Hz and 100 Hz and the frequency of the URS-current 143 Hz are very analgetic.

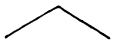
It has been noted that percutaneous treatment with the frequencies 8-31 Hz have a clear effect on activating the blood-flow. Also the periferic blood-flow can be improved by the frequencies 105-173 Hz.

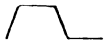
To stimulate the motor nerves low frequencies 5-25 Hz are used. To achieve strong muscle contraction the most suitable frequencies are 30-50 Hz.

Treatment programs

There have been programmed into the interEST EST220 interference therapy unit 81 treatment programs. Programs with low frequencies 1-9, 49-51, 73-75, 79-81 and programs with high frequencies 7-48, 55-66, 73-81 are planned for the pain inhibition. Programs 4-6, 52-54, 73-75 improve blood-flow and programs 49-72 stimulate the motor nerves.

Symbols in the program list

 = interference frequency increases in 6 seconds from minimum to maximum and decreases in 6 seconds from maximum to minimum etc.

 = interference frequency increases in 1 second from minimum to maximum, stays in maximum 5 seconds and decreases in 1 second to minimum and stays in minimum 5 seconds etc.

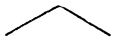
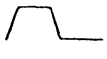
= interference frequency increases suddenly to maximum, stays in maximum 1 second, decreases suddenly to minimum and stays in minimum 1 second etc.

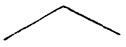
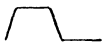
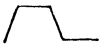
2 el = 2 electrodes in use (output only from channel I)

4 el = 4 electrodes in use (output from both channels)

4 elV = 4 electrodes with the interference vector rotation, the duration of the rotation of the vector from 0^{o} to 90^{o} in 13 seconds and back from 90^{o} to 0^{o} in 13 seconds etc.

Program list

Program nr			
1	0 - 10 Hz		4 elV
2	"	"	4 el
3	"	"	2 el
4	0 - 30 Hz	"	4 elV
5	"	"	4 el
6	"	"	2 el
7	0 - 100 Hz	"	4 elV
8	"	"	4 el
9	"	"	2 el
10	30 - 100 Hz	"	4 elV
11	"	"	4 el
12	"	"	2 el
13	"		4 elV
14	"	"	4 el
15	"	"	2 el

Program nr			
16	30 - 100 Hz		4 elV
17	"	"	4 el
18	"	"	2 el
19	50 - 100 Hz		4 elV
20	"	"	4 el
21	"	"	2 el
22	"		4 elV
23	"	"	4 el
24	"	"	2 el
25	"		4 elV
26	"	"	4 el
27	"	"	2 el
28	60 - 100 Hz	"	4 elV
29	"	"	4 el
30	"	"	2 el
31	70 - 100 Hz		4 elV
32	"	"	4 el
33	"	"	2 el
34	"		4 elV
35	"	"	4 el
36	"	"	2 el
37	"		4 elV
38	"	"	4 el
39	"	"	2 el
40	90 - 100 Hz		4 elV
41	"	"	4 el
42	"	"	2 el
43	"		4 elV
44	"	"	4 el
45	"	"	2 el
46	"		4 elV
47	"	"	4 el
48	"	"	2 el
49	2 Hz	continuous	4 elV
50	"	"	4 el
51	"	"	2 el

Program nr			
52	16 Hz	continuous	4 elV
53	"	"	4 el
54	"	"	2 el
55	50 Hz	"	4 elV
56	"	"	4 el
57	"	"	2 el
58	90 Hz	"	4 elV
59	"	"	4 el
60	"	"	2 el
61	100 Hz	"	4 elV
62	"	"	4 el
63	"	"	2 el
64	140 Hz	"	4 elV
65	"	"	4 el
66	"	"	2 el

67 30 Hz, continuous, 2 el, intensity increases from 0 mA to maximum in 2 seconds, stays in maximum 4 seconds, decreases from maximum to 0 mA in 2 seconds and stays in 0 mA 10 seconds etc.

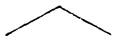
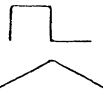
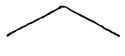
68 similar to the program 67 but the intensity stays in 0 mA 5 seconds

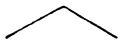
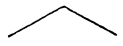
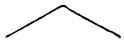
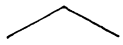
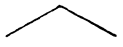
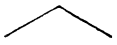
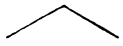
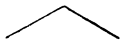
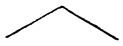
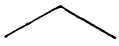
69 similar to the program 67 but the intensity stays in 0 mA 3 seconds

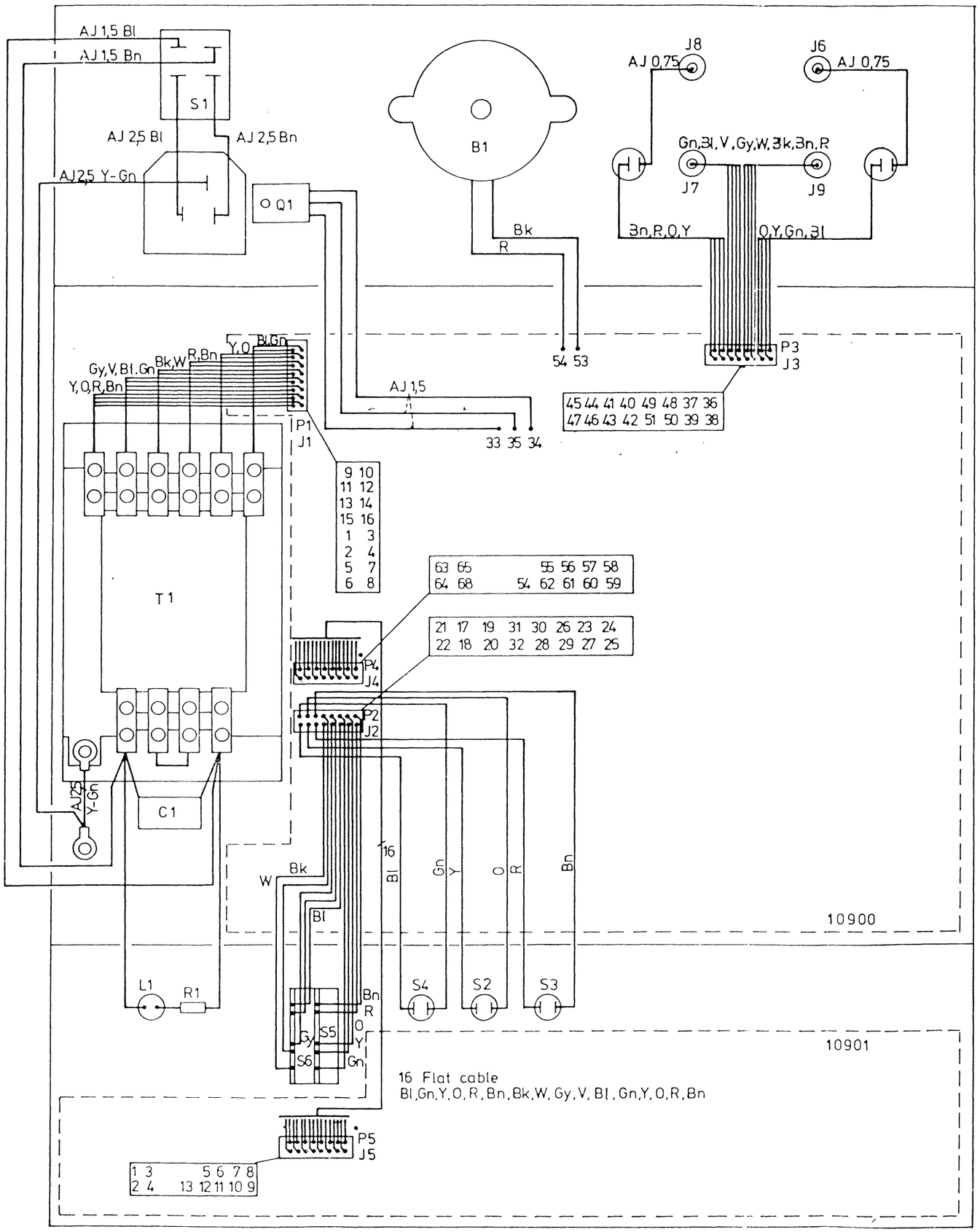
70 50 Hz, continuous, 2 el, intensity increases from 0 mA to maximum in 2 seconds, stays in maximum 4 seconds, decreases from maximum to 0 mA in 2 seconds and stays in 0 mA 10 seconds etc.

71 similar to the program 70 but the intensity stays in 0 mA 5 seconds

72 similar to the program 70 but the intensity stays in 0 mA 5 seconds

73	0 - 30 Hz		4 elV	5 minutes
	0 - 100 Hz	"	"	"
	60 - 100 Hz		"	" alarm
74	0 - 30 Hz		4 el	5 minutes
	0 - 100 Hz	"	"	"
	60 - 100 Hz		"	" alarm

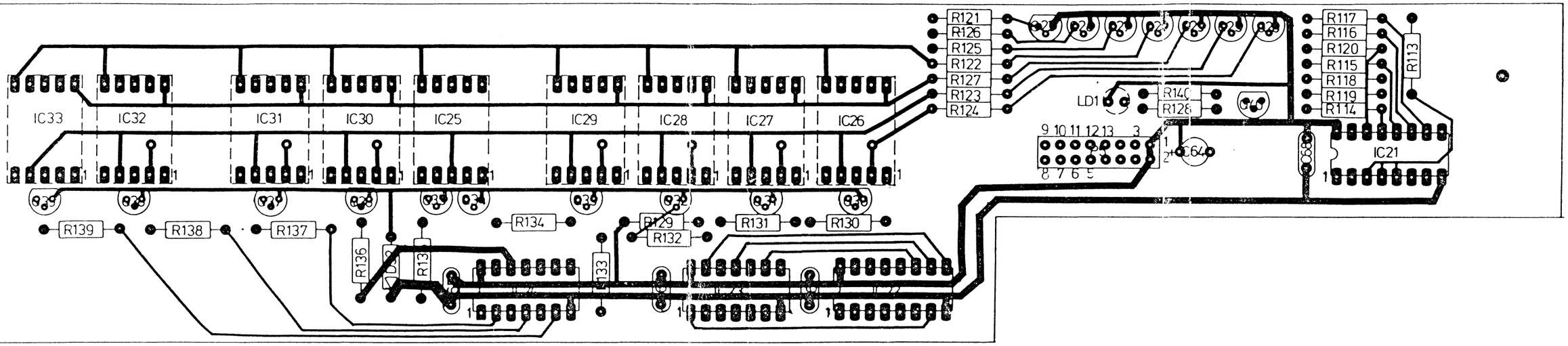
Program nr					
75	0 - 30 Hz		2 el	5 minutes	
	0 - 100 Hz	"	"	"	
	60 - 100 Hz		"	"	alarm
76	90 - 100 Hz		4 elV	2 minutes	
	50 - 100 Hz		"	"	
	70 - 100 Hz		"	"	alarm
77	90 - 100 Hz		4 el	2 minutes	
	50 - 100 Hz		"	"	
	70 - 100 Hz		"	"	alarm
78	90 - 100 Hz		2 el	2 minutes	
	50 - 100 Hz		"	"	
	70 - 100 Hz		"	"	alarm
79	100 Hz	contin.	4 elV	5 minutes	
	0 - 100 Hz		"	"	alarm
80	100 Hz	contin.	4 el	5 minutes	
	0 - 100 Hz		"	"	alarm
81	100 Hz	contin.	2 el	5 minutes	
	0 - 100 Hz		"	"	alarm



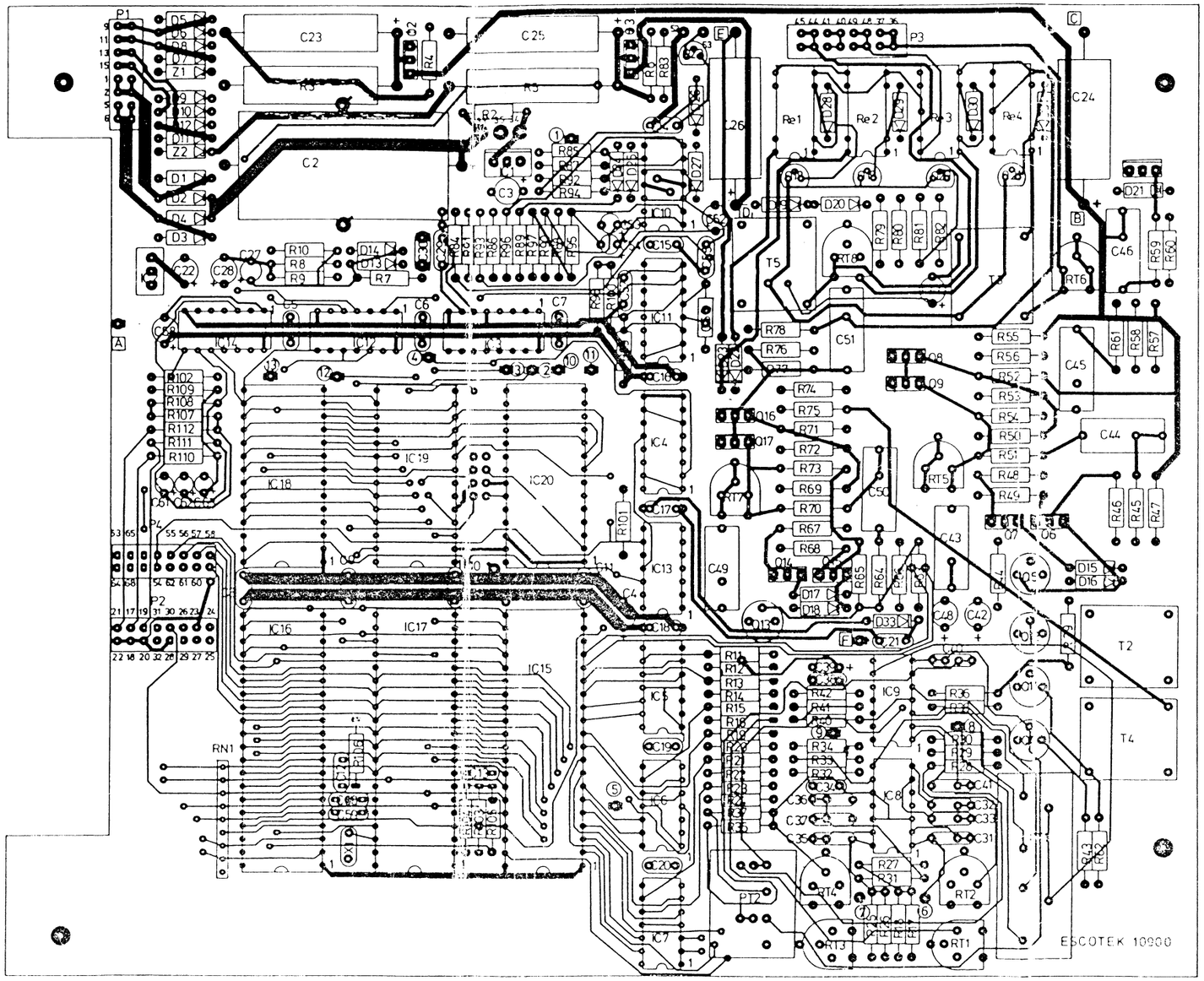
Colours:

R – Red
Bk – Black
Y – Yellow
Gn – Green
Bl – Blue
Bn – Brown
O – Orange
W – White
Gy – Grey
V – Violet

MUUTOS	P.V.M.				
		ESCOTEK KY	1 : 1	SUUNN.	
				TARK.	
				HYV.	
		EST 220			



Muutos	Pvm			
		ESCOTEK Ky	2:1	Suunn. Tark. Hyv.
		EST 220 Components layout	2C10901	



Muutos	Pvm		Sunde 2:1	Kayn. tark.
		ESCOTEK KY		
		EST220 Components layout	10 10900	

220V/50Hz
(110V/60Hz)
T1
POWER
IC1,2,Q2,3
91V
91V
5V
PLL
IC3
÷64
IC4
IC5,6,8
IC7,9
T2
Q5...9
POLARITY
D19,20
Re1,2
OUTPUT
CHANNEL
I
T3
INTENSITY
BALANCE
f_r
f_o/N
f_o
f_I
D-FF
CP
D
IC13
IC6,7,8
IC8,9
T4
Q13...17
POLAR...
D...
Re1,2
Re3,4
OUTPUT
CHANNEL
II
T5
4000 Hz
6
8
4000 Hz - f_I
2
A/D
IC10
PIA
IC15
3
A/D
IC11
A/D
TIMER
IC19
TIMER
IC18
EPROM
IC20
RAM
IC17
R1
INTERFER
FREQUENCY
LED1
BCD/7-SEG
IC21
7
CLOCK, CURRENT
METER DISPLAYS
D26...33
BCD/DEC.
IC22
POLARITY
START
TIME
S2,3,4
PIA
IC16
5V
ONES,TENS
PROGRAM/
TIME
S5,6
IC10900

MUUTOS	PVM				
		ESCOTEK KY	S	SUUNN	
				TARK	
				HYV	
		EST 220	3A10900		
		BLOCK DIAGRAM			

		Eesotek Oy	
		EST 220 Schematic diagram	1810900

P A R T S L I S T EST220 Interference therapy unit Page 1/1

PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
PCB2	PC-board (with components)	3F10901		1 pcs
R113...120,128, 130...139	Resistor,carb.film	1K ,0.25W,+-5%		19 "
R121...127,129	" , "	22R , " , "		8 "
R140	" , "	220R, " , "		1 "
C64	Capacitor,tantal	100u,6.3V,+50/-20%		1 "
C65...68	" ,multi-layer ceramic	100n,50V ,+-20%		4
D82	Diode	1N4002		1 "
Q23...29	Transistor,PNP	2N3906		7 "
Q30...40	" ,NPN	2N3904		11 "
LD1	LED,green	5mm		1 "
IC21	Integrated circuit	74LS47		1 "
IC22	"	74LS145		1 "
IC23,24	"	74LS14		2 "
IC25	"	HDSP5308		1 "
IC26...33	"	HDSP5302		8 "
P19	Connector	16 poles male,825440-8	AMP	1 "

P A R T S L I S T EST220 Interference therapy unit Page 1/2

PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
	Case	1D10000	Escotek	1 pcs
	Handle	3D10001	"	1 "
	Nut for handle	4D10002	"	2 "
	Chassis	2D10900	"	1 "
	Front panel	3D10901	"	1 "
	Back panel	3D10902	"	1 "
	Front glass	4D10305	"	1 "
	Electrode	4D10011	"	4 "
	Electrode	4D10015	"	4 "
	Electrode	4D10016	"	4
	Electrode cover	4D10007	"	4 "
	Electrode cover	4D10018	"	4 "
	Electrode cover	4D10019	"	4 "
	Tightening belt	6.4 x 91.4 cm, 1204	"	2 "
	Tightening belt	6.4 x 121.9 cm, 1206	"	2 "
	PC-board (with components)	1E10900	"	1 "
	PC-board (with components)	1E10901	"	1 "
T1	Transformer	110V+110V/7.5V 2.5A +75V 0.2A +75V 0.2A 50VA		1 "
R1	Resistor,carb.film	330K,0.25W,+-5%		1 "
C1	Capacitor	0u1,250V,PME271	Rifa	1 "
Q1	Transistor,PNP	MJE2955		1 "
L1	Control lamp,yell.	BN9D-0-91.2515	Cannon	1 "
B1	Buzzer	PKB 5-3A0	Murata	1 "
S1	Switch	16A,250V,2600 11EB	Arrow	1 "
S2,3,4	Pushbutton,black	0.1A,24V,9mm		3 "
S5,6	Thumbwheel sw,grey	DPS9-131-AK-L-1	Hartmann	2 "
	End plate pair, "	DPS9-P-1	"	1 pair
	Mains connector	6A,250V (2 pcs 5x20mm fuse holders)		1 pcs
J1...5	Connector	16 pol.,female 1-66242-6	AMP	5 "
J6,8	Connector	4mm banana, female		2 "
J7,9	Connector	4mm banana, female		2 "
	Fuse holder	5x20mm		2 "

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PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
F1,2	Fuse	T315mA, 5x20mm		2 pcs
F3,4	Fuse	F160mA, 5x20mm		2 "
	LED holder	5mm		1 "
	Knob,black	15mm,0.25" shaft		2 "
	Cap for knob,grey	For 15mm knob		2 "
	Pointer,black	" " "		2 "
	Connector,black	4mm,banana		4 "
	Connector,red	4mm,banana		4 "
	Clip connector	Isolated,black		2 "
	Clip connector	Isolated,red		2 "
	Mains cable	2,5m		1 "
	Treatment cable	AdJ1.5,1.5mm2,black		5 m
	Treatment cable	AdJ1.5,1.5mm2,red		5 m

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PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
PCB1	PC-board (with components)	1F10900	Escotek	1 pcs
R4,6	Resistor,carb.film	56K ,0.25W,+-5%		2 "
R7,107...109,141,142	" , "	10K , " , "		6 "
R8,61,78,59	" , "	22K , " , "		4 "
R9,57,58,76,77	" , "	47K , " , "		5 "
R10	" , "	2K2 , " , "		1 "
R17,25	" , "	390R, " , "		2 "
R18,26,30,34,36,38, 40,42,50,51,69,70, 79...83,89,90,96, 97	" , "	1K , " , "		21 "
R28,32,39,43,62	" , "	47R , " , "		5 "
R35,37,41	" , "	680R, " , "		3 "
R46,65	" , "	1K5 , " , "		2 "
R44,63	" , "	1K8 , " , "		2 "
R45,64	" , "	100K, " , "		2 "
R48,49,67,68	" , "	100R, " , "		4 "
R52,54,71,73	" , "	560R, " , "		4 "
R53,72	" , "	82K , " , "		2 "
R60	" , "	12K , " , "		1 "
R88,95	" , "	39K , " , "		2 "
R101,103...106	" , "	3K3 , " , "		5 "
R102,110...112	" , "	470R, " , "		4 "
R2	" , "	10R ,0.5W , "		1 "
R47,66	" , "	22K , " , "		2 "
R55,56,74,75	" , "	100R, " , "		4 "
R11,19	" ,metal.film	9K76,0.25W,+-1%		2 "
R12,20	" , "	19K6, " , "		2 "
R13,21	" , "	40K2, " , "		2 "
R14,22	" , "	80K6, " , "		2 "
R15,23	" , "	162K, " , "		2 "
R16,24	" , "	316K, " , "		2 "
R27,31	" , "	8K5 , " , "		2 "
R29,33	" , "	11K3, " , "		2 "
R84,86,91,93	" , "	22K , " , "		4 "
R85,87,92,94	" , "	10K , " , "		4 "

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PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
R98,100	Resist.,metal film	806R,0.25W,+-1%		2 pcs
R99	" , "	100K, " , "		1 "
R3,5	" ,wire	4K7 , 5W ,+-5%		2 "
RN1	Resistor network	8x2K2,VR8 2k2	ITT	1 "
C2	Capacitor,electrl.	4700u,16V ,+50/-20%		1 "
C23...26	" , "	47u ,160V, "		4 "
C3,4,21,22,28,58	" ,tantal	100u ,6.3V, "		6 "
C42,47,48,52	" , "	22u ,16V , "		4 "
C53,54	" , "	2u2 ,6.3V, "		2 "
C27,39,61...63	" , "	10u , " , "		5 "
C29	" ,ceramic	100p ,500V,+-20%		1 "
C30	" , "	0...100p,select by tests		1 "
C59,60	" , "	27p ,160V,+-20%		2 "
C5...20,34,38, 55,57	" ,multi- layer ceramic	100n ,50V , "		20 "
C31,35	Capacitor,polyest.	4n7 ,100V, "		2 "
C32,33,36,37	" , "	47n , " , "		4 "
C40,41	" , "	22n , " , "		2 "
C43,44,45,46,49, 50,51	" , "	1u , " , "		7 "
C56	" ,polyst.	3n9 ,63V ,+-2%		1 "
D1...12,15...23,33	Diode	1N4002		22 "
D13,14,24...31	"	1N4148		10 "
Z1	Zenerdiode	1N984,91V		2 "
Q2,3,7,9,10,14,17	Transistor,NPN	MJE340		7 "
Q4,5,11...13	" , "	2N3440		5 "
Q6,8,15,16	" ,PNP	MJE350		4 "
Q18...22	" ,NPN	2N3904		5 "
IC1,2	Integrated circuit	7805		2 "
IC3	"	4046		1 "
IC4	"	4520		1 "
IC5...7	"	4066		3 "
IC8...10	"	LM324		3 "
IC11	"	MC14447		1 "
IC12	"	74LS00		1 "
IC13	"	74LS74		1 "

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PART NUMBER	NAME	VALUE,TYPE,MATERIAL	MANUFACTURER	QUANTITY
IC14	Integrated circuit	74LS14		1 pcs
IC15,16	"	MC6821		2 "
IC17	"	MC6802		1 "
IC18,19	"	MC6840		2 "
IC20	"	TMS2564		1 "
X1	Crystal	4MHz,par.reson.,100ppm		1 "
P1...4	Connector	16poles,male,0-825440-8	AMP	4 "
	"	1-726324-2	AMP	14 "
T2...5	Pulse transformer	IT245	Schaffner	4 "
PT1	Potentiometer	2x1K,10 turns,+-10% 83A2AB28J10J10	Bourns	1 "
PT2	"	2x1K,1 turn,+-10% 81A2AB28A10A10	Bourns	1 "
RT1,3	Trimmer,lin	2K2		2 "
RT2,4	" , "	100R		2 "
RT6,8	" , "	50R		2 "
RT5,7	" , "	100K		2 "
Re1...4	Reed-relay	502A-1	Astralux	4 "
	IC-holder	40pins		1 "
	"	28pins		1 "